What is Language?
- Comes from the word for “tongue”
- Combination of sounds for communication
- A symbolic system that is guided by rules
- Uniquely human?
- Nature vs. nurture? Innate vs. learned?

Components of Language
- **Phonemes**: Fundamental language sounds
- **Morphemes**: Smallest meaningful units of words
- **Lexicon**: Collection of all the words in a language
- **Syntax**: Rules of grammar
- **Semantics**: Meaning of words and sentences
- **Prosody**: Vocal intonations
- **Discourse**: Stringing sentences together to form a meaningful narrative
Bimodal Integration in Language

- Speech is more than vocalization
- 90% of speech is accompanied by gestures (visual)

Cocktail Party Effect

- We can hear speech better in a noisy environment if we see the lips
- You can focus on one speaker only by observing the lips (bimodal integration)

McGurk Effect

- When we see and hear conflicting syllables, we hear the syllable that we saw

Language learning

- R/L distinction in Japanese speakers
- French R
- [Kh] sound in Arabic, Hebrew
- [Ch] sound in German

Infants

- Prefer to listen to speech
- Can make sounds used in all languages

Language areas of the brain

- Primary motor cortex: producing words
- Speech motor movements
- Supramarginal gyrus: reading comprehension
- Angular gyrus: reading comprehension
- Wernicke’s area: understanding words
- Primary auditory cortex: hearing words
- Broca’s area: producing words
- Primary motor cortex: speech motor movements
The Localization of Language

- Lesion studies in Humans
  - Wernicke-Geschwind Model
    - Word sounds are sent to the Primary Auditory Cortex
    - Word meaning is represented in Wernicke’s Area
    - Word meaning is sent to Broca’s Area via the **arcuate fasciculus**
    - Broca’s Area sends instructions for speech articulation to the motor cortex
    - To read, visual areas send information to the angular gyrus and to Wernicke’s or Broca’s Area

Language Mapping During Surgery

- Wilder Penfield
  - Mapped language zones during surgery
  - Effects of Cortical Stimulation
    - Total arrest of speech
    - Hesitation and slurring of speech
    - Speech distortion and repetition of speech
    - Confusion of numbers
    - Naming difficulties
    - Misnaming and perseveration

Speech Zones Mapped by Imaging

- Binder and colleagues
  - Speech zones are widespread throughout the brain
Disorders of Language

- Aphasia
  - Disorder of language, writing (agraphia), or reading (alexia)
  - Does not include disorders that result from:
    - Loss of sensory input
    - Motor paralysis or incoordination

Three Categories of Aphasia

- Fluent Aphasia
- Nonfluent Aphasia
- Pure Aphasia

Fluent Aphasias

- Impairment in the reception of language
- Wernicke's Aphasia or Sensory Aphasia
  - Deficits in classifying sounds
  - Word salad
    - Confusion of phonetic characteristics
  - Cannot write
  - Can read in some cases (if damage does not include angular gyrus)
Fluent Aphasias
- Transcortical Aphasia or isolation syndrome
  - Can repeat, understand, and name objects
  - Cannot speak spontaneously
  - Cannot comprehend words

Anomic Aphasia or Amnesic Aphasia
- Can comprehend, produce speech, and can repeat
- Difficulty naming objects

Conduction Aphasia
- Can speak, name objects, and understand speech
- Cannot repeat
- Cannot perform guided speech commands

Nonfluent Aphasias
- Broca’s Aphasia or expressive aphasia
  - Can understand speech
  - Cannot produce or has difficulty producing speech

Transcortical Motor Aphasia
- Good repetition, poor spontaneous production

Global Aphasias
- Labored speech, poor comprehension
**Pure Aphasias**

- **Alexia**
  - Inability to read

- **Agraphia**
  - Inability to write

- **Word deafness**
  - Cannot hear or repeat words

- *Can be selective disorders*

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**Definition of Aphasic Syndromes**

<table>
<thead>
<tr>
<th>Aphasic Syndrome</th>
<th>Type of Speech Disorder</th>
<th>Type of Language Deficits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluent Aphasia</td>
<td>Fluent speech</td>
<td>Brocas or expressive, poor communication, poor repetition, global aphasia, expressive, poor repetition, global aphasia, expressive, poor repetition</td>
</tr>
<tr>
<td>Transcortical mixed aphasia</td>
<td>Fluent speech, nonfluent speech</td>
<td>Brocas or expressive, poor communication, poor repetition, global aphasia, expressive, poor repetition</td>
</tr>
<tr>
<td>Broca’s aphasia</td>
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</tr>
</tbody>
</table>

*Source: *Wolff’s Neurology, 6th Ed., Lippincott**